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Before the
Federal Communications Commission
Washington, D.C. 20554

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

In the Matter of	)	
	)	
1998 Biennial Regulatory Review -- Conducted Emissions Limits Below 30 MHz for Equipment Regulated Under Parts 15 and 18 of the Commission's Rules	)	ET Docket No. 98-80

COMMENTS OF THE
NATIONAL ASSOCIATION OF BROADCASTERS

I. INTRODUCTION AND SUMMARY

In the Commission's *Notice of Inquiry*[1] in the above-captioned proceeding, the agency seeks public comment on the retention, modification or elimination of various FCC regulations aimed at restricting "conducted emissions" from various devices that direct RF signals onto AC power lines. The regulations, found in Parts 15 and 18 of the FCC's rules, address emissions from a variety of electric and electronic devices – devices operating in varying environments. Some of these devices are "intentional" radiators, the function of which is dependent on such emissions; while others are "unintentional" or "incidental" radiators that emit RF signals as a byproduct of the device's primary function. Industrial, Scientific and Medical ("ISM") devices are those where RF energy is used to perform a process, such as exciting the gas in an RF light

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[1] *Notice of Inquiry* in ET Docket No. 98-80 ("*Notice*"), ____FCC Rcd ____(1998).

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bulb. (RF lighting devices are the subject of a separate but related FCC proceeding.[2]) Additionally, the Commission has solicited comment on carrier current systems. These systems intentionally employ AC power lines to deliver their signals.

The National Association of Broadcasters ("NAB")[3] traditionally has supported FCC adoption and refinement of technical standards aimed at ensuring interference-free broadcast service. This is the role we are taking in this proceeding as well. It is our great concern – a concern now supported by scientific evidence – that any lessening of the Commission's conducted emission limits would seriously threaten AM broadcast service. Indeed, it appears that the FCC's existing conducted emission limits may not be strict enough to achieve this goal of interference protection to the AM broadcast service. As such, now is the time for the Commission to confront reality -- the fact that many of its interference protection regulations woefully fail to provide genuine interference protection.

In response to the Commission's *Notice,* NAB commissioned a study to determine the impact of AC power line conducted emissions on modern AM broadcast receivers. The results of this study demonstrate that the Part 15 and Part 18 conducted emissions limits are necessary – and that a 22 dB tightening of these limits is required to provide adequate protection to the AM broadcasting service.

This study, which is attached to these comments as Appendix A and hereinafter referred to as the "Carl T. Jones Study," illustrates several important points concerning the impact of AC

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[2] *See Notice of Proposed Rule Making* in ET Docket No. 98-42, 63 Fed. Reg. 20,362 (April 24, 1998).

[3] NAB is a nonprofit, incorporated association of television and radio stations and broadcast networks that serves and represents the American broadcast industry.

power line conducted emissions on AM radio receivers. These critically important observations and conclusions include the following:

1. Generally speaking, the existing conducted emissions limits adequately protect AM radio receivers *unless the interfering conducted signal happens to fall on the desired (tuned to) AM frequency.*

2. When an interfering conducted signal is on the same frequency as a desired AM signal, a conducted emission limit of no greater than 20 μV is necessary to adequately protect the AM receiver.

In light of these study results, it is clear that Part 15 and Part 18 conducted emission limits are still required to ensure interference-free AM broadcast service. Moreover, it now appears from these data that the existing limits must be made even more strict in order to achieve the interference-protection goals that they were designed to achieve.

II. THE EXISTING PART 15 AND PART 18 CONDUCTED EMISSIONS LIMITS DO NOT EFFECTIVELY CONTROL INTERFERENCE TO AM RADIO.

Those devices that are subject to conducted emissions limits under Parts 15 and 18 of the Commission's rules are subject to a 250 μV limit in the AM broadcast band,[4] except that digital devices and RF lighting equipment designed exclusively for use in commercial, industrial or business environments are subject to a less restrictive 1000 μV limit (3000 μV in the AM expanded band for RF lighting equipment).[5] Also, ultrasonic equipment is subject to a more restrictive 200 μV limit,[6] and there are exceptions made for carrier current systems, which intentionally transmit radio frequency signals over the AC power lines.[7]

[4] *See* 47 CFR Sections 15.107(a), 15.207(a), 18.307(b) and (c).
[5] *See* 47 CFR Sections 15.107(b) and 18.307(c).
[6] *See* 47 CFR Section 18.307(a).
[7] *See* 47 CFR Sections 15.107(c) and 15.207(c).

In the Carl T. Jones Study, six modern radio receivers were tested to determine their susceptibility to interference from conducted emissions in the AM broadcast band. These receivers were purchased in July, 1998, from Washington DC-area electronics stores. A summary of the test results is provided in Tables 1 and 2. The test results clearly show that the existing Part 15 and Part 18 conducted emissions limits provide far too little protection to AM radio.

Table 1: Did FCC Class A and Class B Conducted Emissions Limits Protect Receivers Tested from On-Channel Interference?

	600 kHz Class A / Class B	1000 kHz Class A / Class B	1500 kHz Class A / Class B
General Electric 7-4852A	NO / NO	NO / NO	NO / NO
KOSS HG912	NO / NO	NO / NO	NO / NO
Radio Shack 12-639A	NO / NO	NO / NO	NO / NO
RCA RP 7700A	NO / NO	NO / NO	NO / NO
Sharp MDX5	NO / NO	NO / NO	NO / NO
Sony ICF-C25	NO / NO	NO / NO	NO / NO

Table 2: Level of Interfering Conducted Emission Signal Necessary to Increase Audio Distortion at Receiver's Speaker Output from 25% to 31.6% (Interfering Signal and Desired Signal are on Same Frequency)

	600 kHz	1000 kHz	1500 kHz
General Electric 7-4852A	*	*	*
KOSS HG912	62 μV	23 μV	24 μV
Radio Shack 12-639A	*	*	*
RCA RP 7700A	*	38 μV	6 μV
Sharp MDX5	42 μV	23 μV	24 μV
Sony ICF-C25	*	*	*

* Asterisks indicate that the interfering signal level necessary to cause 31.6% distortion was too low to be measured accurately.

It is evident from these results that the Commission's existing Part 15 and Part 18 conducted emissions limits are woefully inadequate when it comes to ensuring interference-free reception for AM radio listeners. These test results suggest that a conducted emission limit of no greater than 20 μV is needed to provide adequate interference protection to the AM broadcasting service. NAB here asks that the Commission, following the collection and analysis of comments and reply comments in this inquiry phase of this proceeding, to issue a notice of proposed rule making expeditiously, proposing a single, more restrictive AM-band conducted emission limit for all Part 15 and Part 18 equipment.

III. THE DISTINCTION BETWEEN "CLASS A" AND "CLASS B" EMISSIONS LIMITS SHOULD BE ELIMINATED.

It is inappropriate to assume, as the Commission's existing regulatory scheme does, that radio listeners in commercial, industrial or business environments do not require or deserve the same amount of interference protection as people who listen at home. According to the Radio Advertising Bureau's *Radio Marketing Guide & Fact Book*, 21% of all radio listening occurs somewhere other than at home or inside a vehicle.[8] Because 96% of all consumers listen to the radio every week,[9] this means that 20% of all consumers -- over 50 million Americans – listen to the radio outside their homes or vehicles. It is just as important for at-work listeners to be able to receive news bulletins, weather and traffic reports, and other information provided by AM broadcasters as it is for in-home listeners to be able to receive this same programming. The Commission should modify its rules to provide equal protection to at-work listeners by eliminating its two-tiered approach to Part 15 and Part 18 emissions compliance and replacing it with radiated and conducted emissions limits that apply across the board in all environments, at least insofar as such limits would protect AM broadcasting and other local broadcast services.

[8] *Radio Marketing Guide & Fact Book*, Radio Advertising Bureau, p. 9 (1998).
[9] *Id.* at 2.

IV. ALL PRODUCTS THAT PRODUCE CONDUCTED EMISSIONS IN THE AM BROADCAST BAND SHOULD BE REQUIRED TO COMPLY WITH THE COMMISSION'S EMISSIONS LIMITS.

The Commission's rules currently allow many devices to avoid compliance with specific emissions limits under Parts 15 and 18. For example, digital devices used exclusively as industrial, commercial or medical test equipment, and digital devices used exclusively in appliances are exempt from the Part 15 technical standards.[10] Also, the Part 18 conducted emissions limits apply only to ultrasonic equipment, induction cooking ranges, and RF lighting devices.[11] In order to adequately protect the AM broadcasting service, these and all other loopholes must be closed. It simply makes no sense to, for example, on the one hand control the emissions from an RF light bulb in a kitchen and on the other hand permit the refrigerator in the same kitchen to pump an unlimited amount of RF pollution into the AM broadcast band. All electrical and electronic devices, whether they are intentional, unintentional or incidental radiators must be subject to the same emissions restrictions in order to provide adequate protection to the AM broadcasting service.

Although Section 15.5(b) of the Commission's rules already stipulates that "operation of an intentional, unintentional, or incidental radiator is subject to the conditions that no harmful interference is caused and that interference must be accepted ..."[12] and Section 18.111 contains similar language for ISM equipment, these clauses by themselves are not adequate to protect the AM broadcasting service from interference. Again using the example of the refrigerator, it is unreasonable to assume that people are going to turn off their refrigerators to eliminate AM radio

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[10] *See* 47 CFR Section 15.103(c) and (d).
[11] *See* 47 CFR Section 18.307.
[12] *See* 47 CFR Section 15.5(b).

interference that either they or their neighbors in the next apartment are experiencing. Furthermore, in many cases most people likely do not even realize where interference to AM radio is coming from when it is caused by some type of appliance that would not normally be thought of as an RF generator. All of these facts lead to the conclusion that FCC emissions limits are needed for all types of devices that produce energy in the AM broadcast band whether they be intentional, unintentional or incidental radiators.

Although such a regulatory approach might entail additional tasks for the agency -- and would result in increased numbers of types of electrical and electronic devices being subject to FCC regulation -- this the only course that effectively will protect the range of communications services upon which the public relies. It is our belief that the agency possesses the jurisdiction and authority necessary to adopt such regulations. Indeed, protection of communications services from interference is at the core of the Commission's responsibilities and the agency's fundamental *raison d'être*.

However, if deemed necessary or advisable, NAB would support Congressional efforts aimed at conferring specific and wide-ranging authority on the agency to support such a comprehensive regulatory scheme of interference protection. Such a regulatory approach is the only way that the public may be assured that interference not continue to contaminate broadcast and other communications services.

V. THE CARRIER CURRENT RULES SHOULD BE MODIFIED TO REDUCE CONDUCTED EMISSIONS IN THE AM BROADCAST BAND FROM CARRIER CURRENT TRANSMISSIONS NOT INTENDED FOR RECEPTION BY AM RADIO RECEIVERS.

The Commission's rules currently allow carrier current transmissions *not* intended for reception by a standard AM broadcast receiver to comply with a 1000 μV conducted emission limit in the AM broadcast band.[13] Carrier current transmissions of this nature pose a very significant interference threat to AM radio. In order to adequately protect AM radio, these types of carrier current transmissions should be subject to the same conducted emissions limits in the AM band that apply to non-carrier current systems. That is, any carrier current transmissions not intended for reception by a standard AM broadcast receiver should be restricted to a single conducted emission limit of no greater than 20 μV in the 535-1705 kHz band, as discussed earlier in these comments and as supported by the Carl T. Jones Study. NAB's concern here, again, is with potential and real interference to the AM broadcast service (and to any other broadcast or auxiliary broadcast operation). Should carrier current systems be proposed that would not create such interference, then NAB would not interpose an objection to these systems' deployment and use.

[13] *See* 47 CFR Sections 15.107(c)(2) and 15.207(c)(2).

VI. CONCLUSION

NAB applauds the Commission for instituting the instant proceeding. However, rather than taking a course of reduced regulatory oversight and less stringent regulation, it is clear that now is the time for the FCC to devise more effective and more comprehensive interference protection measures. We urge the Commission to institute rulemaking proceedings, over the very near term, which will yield a regulatory system providing the public with interference-free service from AM broadcast and other local broadcast operations.

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September 8, 1998

APPENDIX A

TEST PLAN/TEST RESULTS SUSCEPTIBILITY OF AM RECEIVERS TO POWER-LINE CONDUCTED EMISSIONS

CARL T. JONES
CORPORATION

TEST PLAN/TEST RESULTS
SUSCEPTIBILITY OF AM RECEIVERS
TO POWER-LINE CONDUCTED EMISSIONS

August 17, 1998

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TO POWER-LINE CONDUCTED EMISSIONS

TEST PLAN/TEST RESULTS
SUSCEPTIBILITY OF AM RECEIVERS
TO LINE CONDUCTED EMISSIONS

1.0 Introduction

This test plan sets forth a test method and procedures for quantifying the susceptibility of AM radio receivers to line conducted emissions. The Federal Communications Commission (FCC) has established limits on the voltage levels which can be conducted onto the AC power lines under Parts 15 and 18 of it's Rules and Regulations. Part 15 addresses conducted emissions limits for intentional and unintentional radiators, while Part 18 addresses limits for Industrial Scientific and Medical (ISM) equipment. Recently the FCC issued a Notice of Inquiry (ET Docket 98-80) which in part invites comment as to the necessity of the Part 15 and 18 conducted emissions limits.

2.0 Test Methodology

A block diagram of the basic test system for measuring power-line conducted interference is shown in the attached Exhibit 1. Each AM receiver under test (RUT) is tuned to receive the first desired signal as selected on the desired signal generator. With the RUT's volume control adjusted for approximately mid range, the level of the desired signal is adjusted to produce a 12 dB SINAD level (25% audio distortion) as measured with an audio analyzer. SINAD is an Electronics Industry Association (EIA) standard for measuring receiver performance [(signal + noise + distortion)/(noise + distortion)] at the audio output (speaker) of the receiver. The 12 dB SINAD level is used as the reference in measuring further degradation of the audio output signal in the presence of line conducted interfering signals. For the purpose of this test a further audio degradation to a level of 10 dB SINAD (31.6% audio distortion) is considered to be significant.

With the RUT and desired signal level adjusted as described above an undesired interfering signal is injected onto the RUT's power cable by means of a second signal generator and a current probe. The undesired signal may be injected Common mode or differential mode by using this technique. The undesired signal is amplitude modulated with a 400 Hz tone to simulate a typical line conducted emission which might be generated from a switching power supply or digital clock. The level of the interfering signal is measured using a Line Impedance Stabilization Network (LISN) and a spectrum analyzer

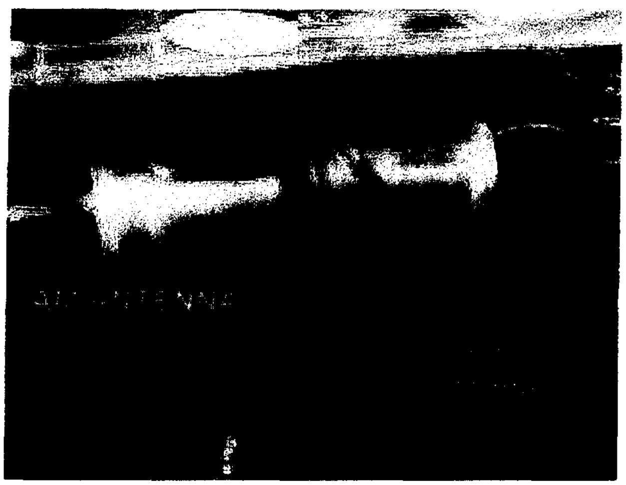
In order to perform the actual interference test, the level of the interfering signal is first adjusted well above the FCC Class A limit as defined in Part 15 of the FCC's Rules. If no audio degradation is observed or if the degradation results in a SINAD level of 10 dB or greater, it is assumed that no significant audio degradation is present and the second interfering signal is selected on the generator. If audio degradation is observed which results in a SINAD level less than 10 dB, the interfering signal is reduced until a level of 10 dB SINAD is achieved and the interfering signal level as measured on the spectrum analyzer is recorded.

For each RUT, interference tests are performed for three desired frequencies (f_o) and six interfering frequencies. The desired frequencies are 600 KHz, 1000KHz and 1500 KHz representing the low, middle and upper portions of the AM frequency band. The six undesired frequencies are: 1) the local oscillator frequency (LO); 2) the intermediate frequency (IF); 3) the desired frequency (f_o); 4) f_o + LO; 5) 2 f_o; and 6) 3 f_o. In the case of the desired frequency of 600 KHz, there are only five (5) undesired test frequencies since the local oscillator (LO) frequency falls below the 450 kHz to 30 MHz frequency band regulated by the FCC.

3.0 Test Procedures

3.1 Initial setup

Each RUT is first configured to receive the desired signal from the signal generator by transformer coupling the generator output to the RUT's antenna via a coiled wire around the RUT's *internal* AM antenna or, where possible, by using an RF current clamp attached to the RUT's *external* loop antenna. The following picture shows transformer coupling via a wire coiled around an internal AM antenna. The two ends of the coil (wire) were attached to the output port of the RF signal generator via a coaxial cable with alligator clips. When an RF current clamp was used it was connected directly to the RF Generator via a coaxial cable.



3.2 Initial Calibration

Each RUT is configured for testing as shown in the Test System Block Diagram contained in Exhibit 1. The initial calibration is performed without the undesired signals present.

After a suitable warm-up period, each RUT is initially calibrated by adjusting its volume control to approximately mid-range. The desired signal generator is adjusted for the first desired signal frequency and the RUT channel selector is adjusted to receive the test signal. The test signal carrier amplitude is then adjusted until a SINAD level of 12 dB is achieved as measured on the audio analyzer.

3.3 Line Conducted Interference Measurements

After setting up and calibrating the RUT as described above, the undesired interference signal is adjusted for the first interfering frequency, and an amplitude greater than the FCC's Class A digital device limits, as measured at the output port of the LISN. All undesired signal amplitude levels are measured on the spectrum analyzer using quasi-peak detection.

If audio degradation is observed which results in a SINAD level of less than 10 dB, the interfering signal is reduced until a level of 10 dB SINAD is achieved, and the interfering signal level as measured on the spectrum analyzer is recorded for both the high and low side of the RUT's power cable. If no audio degradation is observed or if the degradation results in a SINAD level of 10 dB or greater, it is assumed that no significant audio degradation is present and the starting interfering signal level is recorded. This procedure is repeated for all six undesired frequencies. The the entire procedure is repeated for the remaining two desired frequencies.

Note: When the interfering signal is adjusted for the desired frequency, it may not be possible to exactly achieve a 10 dB SINAD level due to the sensitivity of the receiver to in-band signals. In other words the signal in the presence of the in-band interfering signal will fluctuate between total distortion and no distortion for very low interfering signal levels.

4.0 Test Results

4.1 General

Tests were performed on the following six receivers: 1) SONY, Model ICF-C25, S/N E5003735; 2) RCA, Model RP7700A, Date Code 3802cG; 3) RADIO SHACK, Model 12-639A, S/N 4A8; 4) KOSS, Model HG912, Manufactured April 1998; 5) SHARP, Model MD-X5, S/N 70800324 and 6) GE, Model 7-4852A, Date Code 4817RA. Each of the receivers is of recent manufacture.

Power line conducted interference tests were performed on each receiver as described in the preceding sections. All receivers were tested for common mode interference, while the SONY receiver was also tested for differential mode interference.

In summary, each of the receivers tested was found to be highly susceptible to line conducted emissions when the emission frequency was the same as the desired frequency (in-band interference). Significant audio distortion occurred in all receivers when the interfering signal level was at or below the FCC Class B limit of 250 uV. At all other interfering frequencies, the receivers showed good immunity to line conducted emissions, in most cases at levels above the FCC Class A limit. There was no significant difference in observed audio quality between common mode and differential mode tests.

Test results for all six receivers, at each of the three desired frequencies, are contained in Exhibits 2, 3 and 4. The differential mode test results are contained in Exhibit 5.

4.2 Tests Results for Undesired Signal Frequency = f_o (In-band Interference)

All six test samples displayed severe audio degradation when the undesired (interfering) signal was adjusted to the operating frequency (f_o) of the RUT. The three worst performing receivers could not be adjusted to obtain a 10 dB SINAD measurement in the presence of a line conducted emission at the desired operating frequency. On these three receivers, while adjusting the undesired interference signal level in an attempt to bring the audio quality to a 10 dB SINAD level, it was observed that the distortion was either out of the range of the SINAD meter or it was at the 12 dB or greater SINAD level for extremely low conducted emission levels. On the three other receivers, a 10 dB SINAD level was achieved when the amplitude of the conducted emission was adjusted to a level well below the FCC Class B limit. In other words, conducted emission levels well below the FCC Class B limit resulted in significant audio distortion when the undesired frequency was the same as the desired frequency (in-band interference).

4.3 Test Results For Remaining Undesired Frequencies (LO, IF, f_o + LO, 2 f_o, 3 f_o)

For all other undesired test frequencies, no receiver exhibited audio degradation at emission levels at or below the FCC Class B limit. Four of the six receivers exhibited no audio degradation at emission levels above the FCC Class A limit. Two of the receivers exhibited significant audio degradation at emission levels between the Class A and Class B limits. A summary of the pertinent data for these two receivers, extracted from Exhibits 2 through 4 is shown below.

Note: The FCC's general power-line conducted limit under Part 15 of the Rules is 250 uV (48 dBμV) and the limits for Class A digital devices are 1000 μv (60 dBμV) from 450 kHz to 1.705 MHz and 3,000 uV (69.5 dBμV) from 1.705 MHz to 30 MHz.

Radio Shack Receiver Pertinent Test Results

Operating Frequency	Undesired Frequency	10 dB SINAD Level
600 kHz	455 kHz (IF)	High Side = 54.5 dBμV Low Side = 53.7 dBμV
1000 kHz	455 kKz (IF)	High Side = 59.8 dBμV Low Side = 59.0 dBμV
1500 kHz	455 kHz (IF)	High Side = 58.8 dBμV Low Side = 58.1 dBμV

KOSS Receiver Pertinent Test Results

Operating Frequency	Undesired Frequency	10 dB SINAD Level
1500 kHz	4500 kHz ($3f_o$)	High Side = 69.5 dBμV Low Side = 70.3 dBμV

4.4 Differential Mode Test Results

The SONY receiver was tested with the current probe configured to inject the undesired line conducted emission on only one side of the AC power cord. Both high and low sides were tested. The differential mode test results, contained in Exhibit 5, show no significant difference in audio distortion levels between high and low side tests or between common mode and differential tests.

4.5 Test Results Summary

The six AM receivers tested exhibited severe audio distortion when the line conducted emission frequency was the same as the desired frequency (in-band interference). The audio distortion occurred at emission levels well below the FCC Class B limit. At all other undesired frequencies the receivers generally exhibited good performance in most cases when the emission levels were above the FCC Class A limit. There appeared to be no significant difference in receiver performance between common mode and differential mode interfering signals, although testing in the differential mode was limited to a single receiver.

Power-Line Conducted Interference Test System Block Diagram

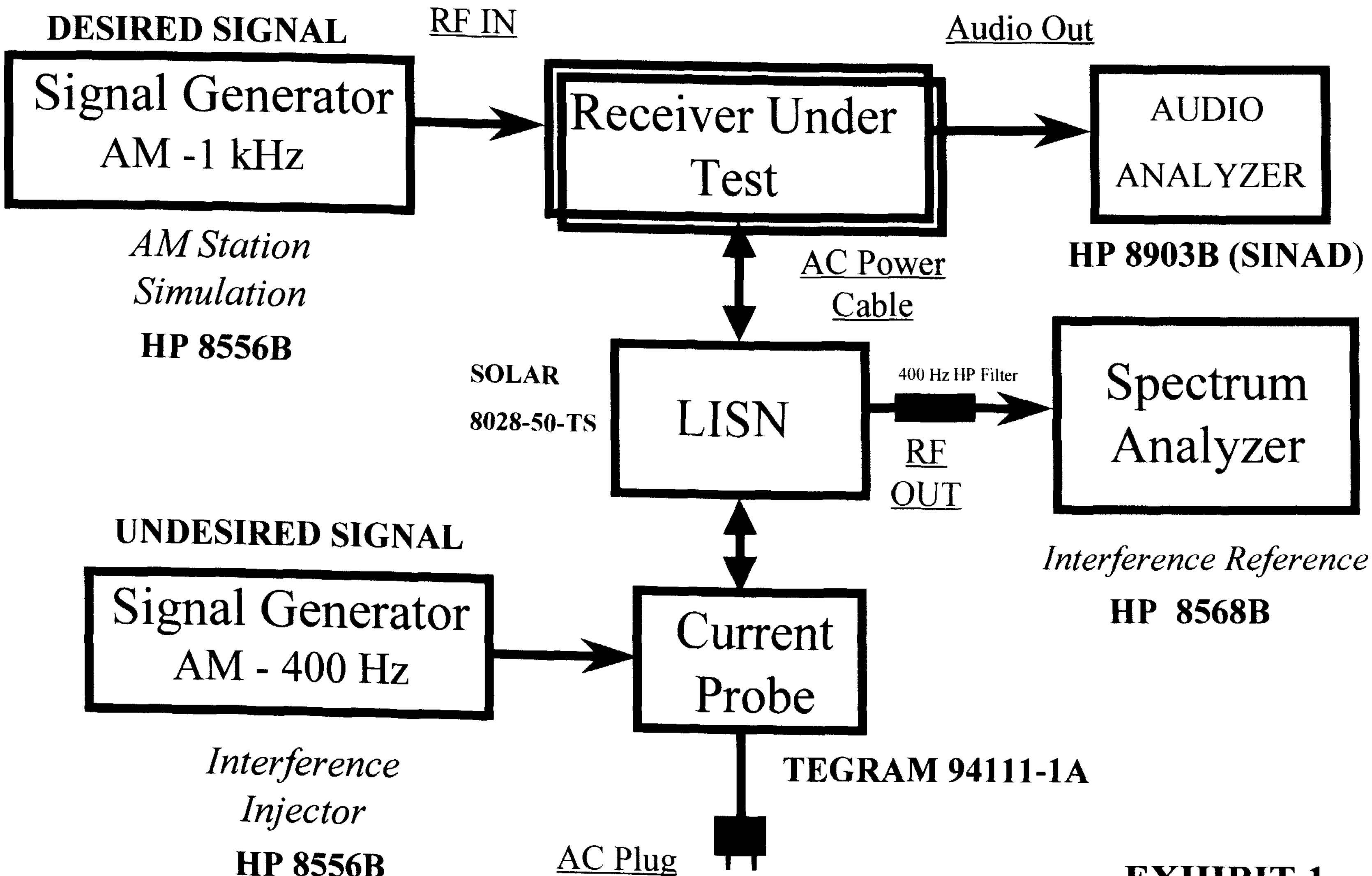


EXHIBIT 1

EXHIBIT 2
RECEIVER PERFORMANCE RESULTS
OPERATING FREQUENCY 600 kHz

GE, Model: 7-4852A **Desired: 600 kHz**

Initial Calibration - no undesired signal present

Gen. Setting: 24.5 dBμV, = 12 dB SINAD (25% Distortion)

Mode: Common Mode

Undesired = 455 kHz = 12.0 dB SINAD

High Side = 80.5 dBμV (Limit = 60.0 dBμV)

Low Side = 80.3 dBμV (Limit = 60.0 dBμV)

Comments: No degradation

Undesired = 600 kHz = N/A dB SINAD

High Side = 48.2 dBμV (Limit = 60.0 dBμV)

Low Side = 48.0 dBμV (Limit = 60.0 dBμV)

Comments: Below General Limit of 48 dBμV, not measurable

Undesired = 745 kHz = 12.0 dB SINAD

High Side = 72.5 dBμV (Limit = 60.0 dBμV)

Low Side = 71.7 dBμV (Limit = 60.0 dBμV)

Comments: No degradation

Undesired = 1200 kHz = 12.0 dB SINAD

High Side = 66.1 dBμV (Limit = 60.0 dBμV)

Low Side = 65.3 dBμV (Limit = 60.0 dBμV)

Comments: No degradation

Undesired = 1800 kHz = 12.0 dB SINAD

High Side = 69.9 dBμV (Limit = 69.5 dBμV)

Low Side = 70.3 dBμV (Limit = 69.5 dBμV)

Comments: No degradation

Limit = Class A

KOSS, Model: HG912 **Desired: 600 kHz**

Initial Calibration - no undesired signal present

Gen. Setting: -1.9 dBμV, = 12 dB SINAD (25% Distortion)

Mode: Common Mode

Undesired = 455 kHz = 12.0 dB SINAD

High Side = 61.1 dBμV (Limit = 60.0 dBμV)

Low Side = 60.4 dBμV (Limit = 60.0 dBμV)

Comments: No degradation

Undesired = 600 kHz = 10.0 dB SINAD

High Side = 36.0 dBμV (Limit = 60.0 dBμV)

Low Side = 35.9 dBμV (Limit = 60.0 dBμV)

Comments: Below General Limit of 48 dBμV

Undesired = 745 kHz = 12.0 dB SINAD

High Side = 75.3 dBμV (Limit = 60.0 dBμV)

Low Side = 74.9 dBμV (Limit = 60.0 dBμV)

Comments: No degradation

Undesired = 1200 kHz = 12.0 dB SINAD

High Side = 69.1 dBμV (Limit = 60.0 dBμV)

Low Side = 68.9 dBμV (Limit = 60.0 dBμV)

Comments: No degradation

Undesired = 1800 kHz = 12.0 dB SINAD

High Side = 69.9 dBμV (Limit = 69.5 dBμV)

Low Side = 70.4 dBμV (Limit = 69.5 dBμV)

Comments: No degradation

Limit = Class A

RADIO SHACK, Model: 12-639A **Desired: 600 kHz**

Initial Calibration - no undesired signal present

Gen. Setting: 0.5 dBμV, = 12 dB SINAD (25% Distortion)

Mode: Common Mode

Undesired = 455 kHz = 10.0 dB SINAD

High Side = 54.5 dBμV (Limit = 60.0 dBμV)

Low Side = 53.7 dBμV (Limit = 60.0 dBμV)

Comments: Above general limit, below Class A

Undesired = 600 kHz = N/A dB SINAD

High Side = 48.0 dBμV (Limit = 60.0 dBμV)

Low Side = 48.5 dBμV (Limit = 60.0 dBμV)

Comments: Below General Limit of 48 dBμV, not measurable

Undesired = 745 kHz = 12.0 dB SINAD

High Side = 65.4 dBμV (Limit = 60.0 dBμV)

Low Side = 64.8 dBμV (Limit = 60.0 dBμV)

Comments: No degradation

Undesired = 1200 kHz = 12.0 dB SINAD

High Side = 62.3 dBμV (Limit = 60.0 dBμV)

Low Side = 61.2 dBμV (Limit = 60.0 dBμV)

Comments: No degradation

Undesired = 1800 kHz = 12.0 dB SINAD

High Side = 72.7 dBμV (Limit = 69.5 dBμV)

Low Side = 70.7 dBμV (Limit = 69.5 dBμV)

Comments: No degradation

Limit = Class A

RCA, Model: RP 7700A **Desired: 600 kHz**

Initial Calibration - no undesired signal present

Gen. Setting: 7.5 dBµV, = 12 dB SINAD (25% Distortion)

Mode: Common Mode

Undesired = 455 kHz = 12.0 dB SINAD

High Side = 80.1 dBµV (Limit = 60.0 dBµV)

Low Side = 79.3 dBµV (Limit = 60.0 dBµV)

Comments: No degradation

Undesired = 600 kHz = N/A dB SINAD

High Side = 48.0 dBµV (Limit = 60.0 dBµV)

Low Side = 48.5 dBµV (Limit = 60.0 dBµV)

Comments: Below General Limit of 48 dBµV, not measurable

Undesired = 745 kHz = 12.0 dB SINAD

High Side = 72.2 dBµV (Limit = 60.0 dBµV)

Low Side = 71.7 dBµV (Limit = 60.0 dBµV)

Comments: No degradation

Undesired = 1200 kHz = 12.0 dB SINAD

High Side = 66.6 dBµV (Limit = 60.0 dBµV)

Low Side = 66.0 dBµV (Limit = 60.0 dBµV)

Comments: No degradation

Undesired = 1800 kHz = 12.0 dB SINAD

High Side = 76.1 dBµV (Limit = 69.5 dBµV)

Low Side = 76.3 dBµV (Limit = 69.5 dBµV)

Comments: No degradation

Limit = Class A

SHARP, Model: MDX5 **Desired: 600 kHz**

Initial Calibration - no undesired signal present
Gen. Setting: -1.1 dBμV, = 12 dB SINAD (25% Distortion)
Mode: Common Mode

Undesired = 455 kHz = 12.0 dB SINAD
High Side = 79.1 dBμV (Limit = 60.0 dBμV)
Low Side = 78.3 dBμV (Limit = 60.0 dBμV)
Comments: No degradation

Undesired = 600 kHz = 10.0 dB SINAD
High Side = 32.7 dBμV (Limit = 60.0 dBμV)
Low Side = 32.1 dBμV (Limit = 60.0 dBμV)
Comments: Below General Limit of 48 dBμV

Undesired = 745 kHz = 12.0 dB SINAD
High Side = 75.7 dBμV (Limit = 60.0 dBμV)
Low Side = 75.1 dBμV (Limit = 60.0 dBμV)
Comments: No degradation

Undesired = 1200 kHz = 12.0 dB SINAD
High Side = 75.6 dBμV (Limit = 60.0 dBμV)
Low Side = 79.2 dBμV (Limit = 60.0 dBμV)
Comments: No degradation

Undesired = 1800 kHz = 12.0 dB SINAD
High Side = 79.1 dBμV (Limit = 69.5 dBμV)
Low Side = 77.8 dBμV (Limit = 69.5 dBμV)
Comments: No degradation

Limit = Class A

SONY, Model: ICF-C25 **Desired: 600 kHz**

Initial Calibration - no undesired signal present

Gen. Setting: -4.5 dBμV, = 12 dB SINAD (25% Distortion)

Mode: Common Mode

Undesired = 455 kHz = 12.0 dB SINAD

High Side = 82.2 dBμV (Limit = 60.0 dBμV)

Low Side = 81.5 dBμV (Limit = 60.0 dBμV)

Comments: No degradation

Undesired = 600 kHz = N/A dB SINAD

High Side = 48.0 dBμV (Limit = 60.0 dBμV)

Low Side = 47.5 dBμV (Limit = 60.0 dBμV)

Comments: Below General Limit of 48 dBμV, not measurable

Undesired = 745 kHz = 12.0 dB SINAD

High Side = 74.7 dBμV (Limit = 60.0 dBμV)

Low Side = 74.1 dBμV (Limit = 60.0 dBμV)

Comments: No degradation

Undesired = 1200 kHz = 12.0 dB SINAD

High Side = 68.0 dBμV (Limit = 60.0 dBμV)

Low Side = 67.4 dBμV (Limit = 60.0 dBμV)

Comments: No degradation

Undesired = 1800 kHz = 12.0 dB SINAD

High Side = 75.4 dBμV (Limit = 69.5 dBμV)

Low Side = 76.3 dBμV (Limit = 69.5 dBμV)

Comments: No degradation

Limit = Class A